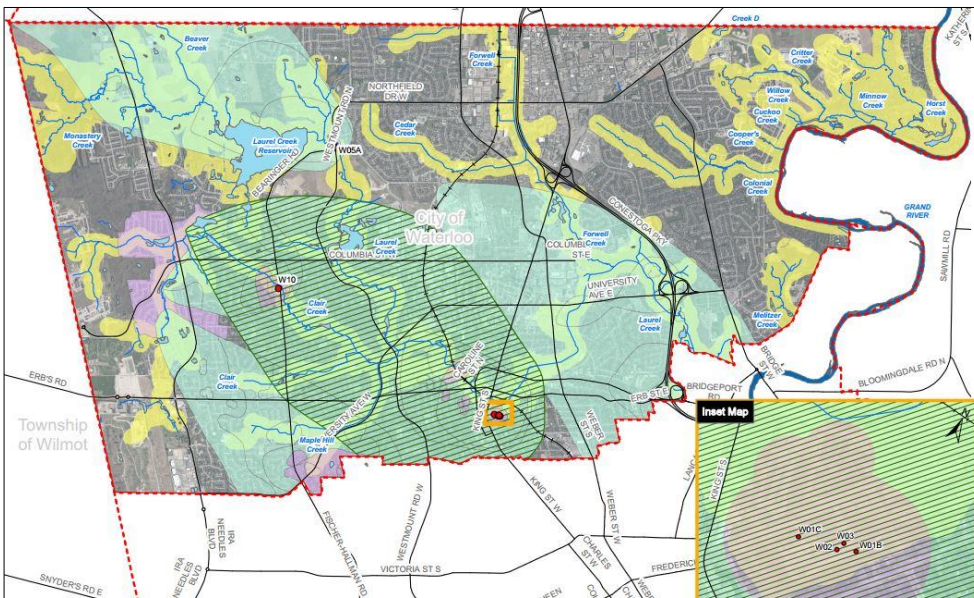


Prepared for:  
The City of Waterloo

# STORMWATER MANAGEMENT MASTER PLAN (SWM-MP) MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT

## Stormwater Infiltration Policy Recommendations



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January 2020  
Final Report



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## 1.0 Introduction

The use of infiltration practices to reduce runoff and restore natural hydrologic processes is crucial to improving the City of Waterloo's natural water systems, maintaining the viability of local stormwater infrastructure, and contributing to climate change adaptation & mitigation strategies. The City has a duty to protect local groundwater resources by implementing a risk-based stormwater infiltration policy which is developed based on a sound understanding of identified and future risks.

## 2.0 Purpose

This memo identifies existing policies related to the infiltration of stormwater runoff and contains recommendations for land-use based policies to identify site specific opportunities, constraints and approaches. It is intended that these recommendations will be integrated into the City of Waterloo Stormwater Management Master Plan (SWM-MP) policies and would be utilized to identify, manage, and implement infiltration based stormwater management controls, commonly referred to as Low Impact Development (LID) controls.

The infiltration policies outlined in this memo are primarily intended to be used for retrofit opportunities and/or the redevelopment of land within the City's current built up area. Where an implementation strategy has been developed through a Subwatershed Study, Master Drainage Plan, Secondary Plan or other planning study the infiltration recommendations contained within these detailed studies will supersede the SWM-MP infiltration policy recommendations.

The recommendations and identification of site specific opportunities, constrains and approaches discussed in this memo relates directly to the protection of local groundwater resources and not the identification of opportunities to maximize groundwater recharge. The approach described below should be used in conjunction with targeting groundwater recharge areas with mapping prepared for the City of Waterloo SWM-MP Plan identifying soil types, surficial geology and significant recharge areas.

## 3.0 Existing Policy

Several existing policies provide a framework for the development of land-use based infiltration policy within the City. It is recognized that as new policies are developed and technical studies are completed by planning authorities, the policies outlined in this memo will adapt to changes as part of an adaptive management approach. Existing policies that provide a framework include:

### 1) Provincial Policy Statement (MMAH, 2014)

The Provincial Policy Statement (PPS) provides policy direction on matters of provincial interest related to land use planning and development. Section 1.6.6.7 of the PPS states that planning for stormwater management shall:

- a) Minimize, or, where possible, prevent increases in contaminant loads;
- b) Minimize changes in water balance and erosion;
- c) Not increase risk to human health and safety and property damage;
- d) Maximize the extent and function of vegetative and pervious surfaces; and
- e) Promote stormwater management best practices, including stormwater attenuation and re-use, and low impact development.

Stormwater management is also discussed in the PPS under section 2.2.1 water wherein it is stated that Planning authorities shall protect, improve or restore the quality and quantity of water by:

- h) Ensuring stormwater management practices minimize stormwater volumes and contaminant loads, and maintain or increase the extent of vegetative and pervious surfaces.

### **2) Stormwater Management Planning and Design Manual (MOE, 2003)**

The Stormwater Management Planning and Design Manual (SWMPDM) provides technical and procedural guidance for the planning, design, and review of stormwater management practices. A companion document to the 2003 SWMPDM is currently under development. This companion document will include volumetric stormwater management targets and recommendations on the implementation of infiltration practices. The 2003 SWMPDM recognizes that lot level and conveyance controls are “required to maintain the natural hydrologic cycle to the greatest extent possible”. Appendix G of the 2003 SWMPDM manual discusses methodology for the retrofitting of existing infrastructure to achieve water balance, water quantity, water quality, and erosion and flood control goals.

### **3) Grand River Watershed Water Management Plan (GRCA, 2014)**

The Water Management Plan addresses the management of surface and ground water resources in the Grand River watershed to 2031. The Watershed Plan pulls together plans such as forestry, fisheries, natural heritage, drinking water source protection, recreation and other planning processes so that linkages can be made for larger scale watershed planning. Section 5.2.1.3.2 of the Grand River Watershed Water Management Plan references covers Urban Stormwater. MOE’s 2003 SWMPDM for design and performance guidance and states that municipalities within the GRCA jurisdiction are collaborating to compose a list of best practices for stormwater control for both new and existing developments.

### **4) City of Waterloo Official Plan (City of Waterloo, 2016)**

The City of Waterloo Official Plan (OP) is used to direct growth and provide policy framework and guidance to the development of the City. The use of LID stormwater management practices and infiltration are discussed in several policies in the OP.

The OP defines Low Impact Development as *“An approach to land development that manages stormwater as close to the source as possible. Infiltration, filtration, storage, evaporation and detainment techniques are employed to mimic predevelopment hydrology. Through low impact development, stormwater is regarded as a resource rather than a waste product.”*

Stormwater management policies are covered in section 5.2.7 of the OP. This section includes the following policies relating to infiltration of stormwater:

**(4)** Stormwater management designs shall address and conform to the recommendations of any applicable subwatershed study or master drainage study. For infill locations where such studies have not been conducted, hydrological and hydrogeological assessments may be required by the City prior to the submission of stormwater management designs. When required, hydrological and hydrogeological studies will be completed by registered/licensed professionals to the satisfaction of the City.

**(5)** Stormwater management plans and designs for all development shall strive to match pre-development water balance conditions in accordance with design guidance provided by the City.

**(8)** All stormwater management systems and facilities involving infiltration shall be designed, constructed and operated in a manner to be protective of groundwater resources. Chloride loading to groundwater shall be evaluated in designated well head protection areas defined by the Region. Additional applicable policies related to water resources are included in section 8.3 of this Plan, including section 8.3.3 dealing with source water protection.

Water resources policies are covered in section 8.3 of the OP. This section includes the following policies relating to infiltration of stormwater:

**(2)** The City will promote and play a leadership role in the efficient and sustainable use of water resources, including practices for water conservation and sustaining water quality. Such practices may include, but are not necessarily limited to, encouraging educational initiatives, supporting the Region in programs related to water conservation, incorporating stormwater management best practices (including low impact development measures), and pursuing technological and other system improvements to address such issues as inflow and infiltration of sanitary sewers.

**(5)** The City will require hydrogeological assessments for development applications, excluding site plan applications, that may have adverse environmental impacts on surface water features and/or groundwater features. Such assessments must document pre-to-post development water balances and include measures to substantially maintain infiltration, recharge, and peak flow rates relative to existing conditions.

**(6)** Sensitive surface water features and sensitive groundwater features will be identified through watershed studies, Source Protection Plans, or other appropriate studies accepted by the City and the other public agencies having jurisdiction. Where identified, these features and their related hydrologic functions will be maintained, enhanced or, where feasible, restored.\*

\*Under Appeal

**(8)** Where feasible and appropriate, development will maximize clean water recharge and conservation measures, including infiltration through lot level infiltration structures, permeable surfaces and bioswales, cisterns for non-potable on-site use, and other innovative alternatives.

Section 10.2.4 of the OP outlines policies associated with Urban Design for Lands Designated Commercial. With respect to the infiltration of stormwater, the following policy applies for lands designated commercial:

**(f)** Predevelopment groundwater infiltration rates are to be maintained to the extent possible, where feasible and appropriate. Infiltration measures shall minimize the risk of contamination to the groundwater, to the satisfaction of the City.

##### **5) Regional Official Plan (Region of Waterloo, 2015)**

The Region of Waterloo Official Plan is used to direct growth and change within the Region while conforming to existing policy framework in order to further the sustainability and livability of the



community. Specific policies within the Regional Official Plan that relate to the infiltration of stormwater are **8.A.5** and **8.A.11**.

**Section 8.A.5** for Development applications within all Source Water Protection Area designations will comply with the following:

“employment uses that would direct infiltration of stormwater run-off without pre-treatment through the use of drywells or artificial/enhanced recharge will not be permitted”

**Section 8.A.11** Within the WPSA 1 designation:

“new individual wastewater treatment systems, private wells, pipelines sewers, stormwater management ponds (or other ponds) and the direct infiltration of stormwater run-off without pre-treatment will not be permitted”

#### **6) Grand River Source Protection Plan (LERSPC, 2016)**

Drinking water source protection plans identify the risks to municipal water quality and water supplies, and the policies and programs that will reduce the risks. Volume II of the Grand River Source Protection Plan covers the Region of Waterloo including the City of Waterloo. Specific policies relating to Stormwater Management within Wellhead Protection Areas (WHPA) and Intake Protection Zones (IPZs) can be found from policy **RW-MC-15** through **RW-CW/NB-40**.

RW-MC-15: For existing discharge of stormwater from a stormwater management facility within vulnerable areas where this activity is a significant drinking water threat, the Ministry of the Environment, in consultation with the owner of the stormwater management facility and following the completion of the assessment identified in policy RW-CW-19, shall ensure that the Environmental Compliance Approval that governs the stormwater management facility includes appropriate terms and conditions to ensure that the activity ceases to be a significant drinking water threat in the following vulnerable areas:

- i. In Wellhead Protection Areas A and B where the vulnerability is equal to ten (10);
- ii. In Wellhead Protection Area E where the vulnerability is greater than or equal to eight (8);
- iii. In Intake Protection Zone Three (3) where the vulnerability is equal to eight (8);
- iv. In Intake Protection Zone One (1);
- v. Where a Nitrate and/or Chloride Issue has been identified, in all Issue Contributing Areas.

RW-MC-16: To ensure the new discharge of stormwater from a stormwater management facility does not become a significant drinking water threat within vulnerable areas where this activity would be a significant drinking water threat:

- a. The Ministry of the Environment shall prohibit the new discharge of stormwater from a stormwater management facility within the Environmental Compliance Approvals process in the following areas as appropriate.
  - i. In Wellhead Protection Area A;
  - ii. In Intake Protection Zone One (1).
- b. The Ministry of the Environment shall ensure that the Environmental Compliance Approval that governs the new discharge of stormwater from a stormwater management facility includes appropriate terms and conditions to ensure the activity does not become a significant drinking water threat when permitted in the following areas as appropriate:

- i. In Wellhead Protection Area B where the vulnerability is equal to ten (10);
- ii. In Wellhead Protection Area E where the vulnerability is greater than or equal to eight (8);
- iii. In Intake Protection Zone Three (3) where the vulnerability is equal to eight (8);
- iv. Where a Nitrate and/or Chloride Issue has been identified, in all Issue Contributing Areas except Wellhead Protection Area A.

The Environmental Compliance Approval should include, as minimum, water quality monitoring measures and reporting annually to the Ministry of the Environment, as appropriate. Where there is a Nitrate, and/or Chloride Issue, groundwater and/or surface water quality shall be monitored for Nitrate and Chloride, respectively.

RW-MC-17: The Regional Municipality of Waterloo and the Area Municipalities shall review and, if necessary, amend their Official Plans and Zoning By-laws to reflect policy RW-MC-16 as it relates to stormwater management in the following areas to ensure these activities never become significant drinking water threats:

- i. In Wellhead Protection Area A;
- ii. In Intake Protection Zone One (1).

RW-MC-18: The Regional Municipality of Waterloo and Area Municipalities shall review and, if necessary, amend their Official Plans to require any development proposals for new stormwater management facilities shall be subject to a study to assess impact and mitigation measures in accordance with the Regional Implementation Guideline for Source Water Protection Studies to the satisfaction of the Regional Municipality of Waterloo within the following areas:

- i. In Wellhead Protection Area B where the vulnerability is equal to ten (10);
- ii. In Wellhead Protection Area E where the vulnerability is greater than eight (8);
- iii. In Intake Protection Zone Three (3) where the vulnerability is greater than eight (8);
- iv. Where a Chloride and/or Nitrate Issue has been identified, in all Issue Contributing Areas except Wellhead Protection Area A.

Where a proposed stormwater management pond is located within 500 metres of a Drinking Water System that obtains water from a bedrock aquifer, the study shall, as a minimum, assess changes in classification of the municipal supply well and or changes in hydrogeological conditions that could affect the pathogen vulnerability to the well.

RW-CW-19: The Area Municipalities, in collaboration with the Regional Municipality of Waterloo and the Ministry of Environment, shall undertake an assessment of stormwater management facilities to determine appropriate scope and type of measures to protect drinking water sources within two (2) years from the date the Source Protection Plan takes effect to ensure that this activity ceases to be a significant drinking water threat in the following areas:

- i. In Wellhead Protection Area A and B where the vulnerability is equal to ten (10);
- ii. In Wellhead Protection Area E where the vulnerability is greater than eight (8);
- iii. In Intake Protection Zone Three (3) where the vulnerability is equal to eight (8);
- iv. Where a Chloride and/or Nitrate Issue has been identified, in all Issue Contributing Areas.

RW-CW-20: To ensure the existing and future discharge of stormwater from a stormwater management facility exempt from Environmental Compliance Approvals does not become or ceases to be a significant drinking water threat:

- a. The future discharge of stormwater from a stormwater management facility within vulnerable areas where this activity would be a significant drinking water threat is designated for the purpose of Section 57 of the Clean Water Act, 2006 and is prohibited within the following vulnerable areas where there is or would be a significant drinking water threat:
  - i. In Wellhead Protection Area A;
  - ii. In Intake Protection Zone One (1).
  
- b. The discharge of stormwater from a stormwater management facility shall be designated for the purpose of Section 58 of the Clean Water Act, 2006 and a Risk Management Plan shall be required with the persons or agencies engaging or proposing to engage in the following areas:
  - a) Existing:
    - i. In Wellhead Protection Area A and B where the vulnerability is equal to ten (10);
    - ii. IN Wellhead Protection Area E where the vulnerability is greater than or equal to eight (8);
    - iii. In Intake Protection Zone One (1);
    - iv. In Intake Protection Zone Three (3) where the vulnerability is equal to eight (8);
    - v. Where a Nitrate and/or Chloride Issue has been identified, in all Issue contributing Areas except in Wellhead Protection Area A.
  
  - b) Future:
    - i. In Wellhead Protection Area B where the vulnerability is equal to ten (10);
    - ii. In Wellhead Protection Area E where the vulnerability is greater than or equal to eight (8);
    - iii. In Intake Protection Zone Three (3) where the vulnerability is equal to eight (8); and
    - iv. Where a Nitrate and/or Chloride Issue has been identified, in all Issue Contributing Areas except Wellhead Protection Area A.

The Risk Management Plan shall include, as a minimum, water quality monitoring and reporting to the Risk Management Official. Where there is a Nitrate and/or Chloride Issue, the Risk Management Plan shall also include water quality monitoring for nitrate or chloride, respectively.

RW-CW-20.1: To promote best management practices and to provide guidance about the importance of source water protection, the Regional Municipality of Waterloo shall develop and implement an incentive program for persons engaging in the existing discharge of stormwater from a stormwater management facility exempt from Environmental Compliance Approvals in the following areas:

- i. In Wellhead Protection Area A and B where the vulnerability is equal to ten (10);
- ii. In Wellhead Protection Area E where the vulnerability is greater than or equal to eight (8);
- iii. In Intake Protection Zone One (1);
- iv. In Intake Protection Zone Three (3) where the vulnerability is equal to eight (8);
- v. Where a Nitrate and/or Chloride Issue has been identified, in all Issue Contributing Areas except in Wellhead Protection Area A.

Additional to the above policies related to stormwater management, the SPP stipulates the following regarding road works:

RW-CW/NB-40: The Regional Municipality of Waterloo and Area Municipalities and the Ontario Ministry of Transportation shall enhance road design measures in Environmental Assessments to modify, widen or



expand existing roads and/or design/develop new roads to minimize the impact from any application of salt on roadways related to the development of new roads in the following areas:

- i. In Wellhead Protection Area B where the vulnerability is equal to ten (10);
- ii. Where a Chloride and/or a Sodium Issue has been identified, and in all Wellhead Protection Areas where the vulnerability is greater than or is equal to six (6). The assessment should make recommendation for enhancement measures to protect drinking water sources to be carried through detailed design and construction of the road.

**WHPAs where the adjusted vulnerability score is equal to or greater than 8**

Of specific concern are WHPAs where the adjusted vulnerability score is equal to or greater than 8. Travel times to the wellhead within these areas are short and it is within the best interest of the City of Waterloo to avoid the implementation of infiltration practices from paved surfaces within these areas. WHPAs with adjusted vulnerability scores equal to or greater than 8 are shown on **Figure 1** along with WHPAs with adjusted vulnerability scores from 2 through 6.

The Ontario Clean Water Act, 2006, defines a Drinking Water Threat as “an activity or condition that adversely affects or has the potential to adversely affect the quality or quantity of any water that is or may be used as a source of drinking water, and includes an activity or condition that is prescribed by the regulation as a drinking water threat.”

Within the City of Waterloo, an Issue Contributing Areas has been identified around the William Street well field. This issue contributing area is for Chloride, Sodium and Trichloroethylene.

**Table 3.0 – Identified Issues for Well Fields in the City of Waterloo**

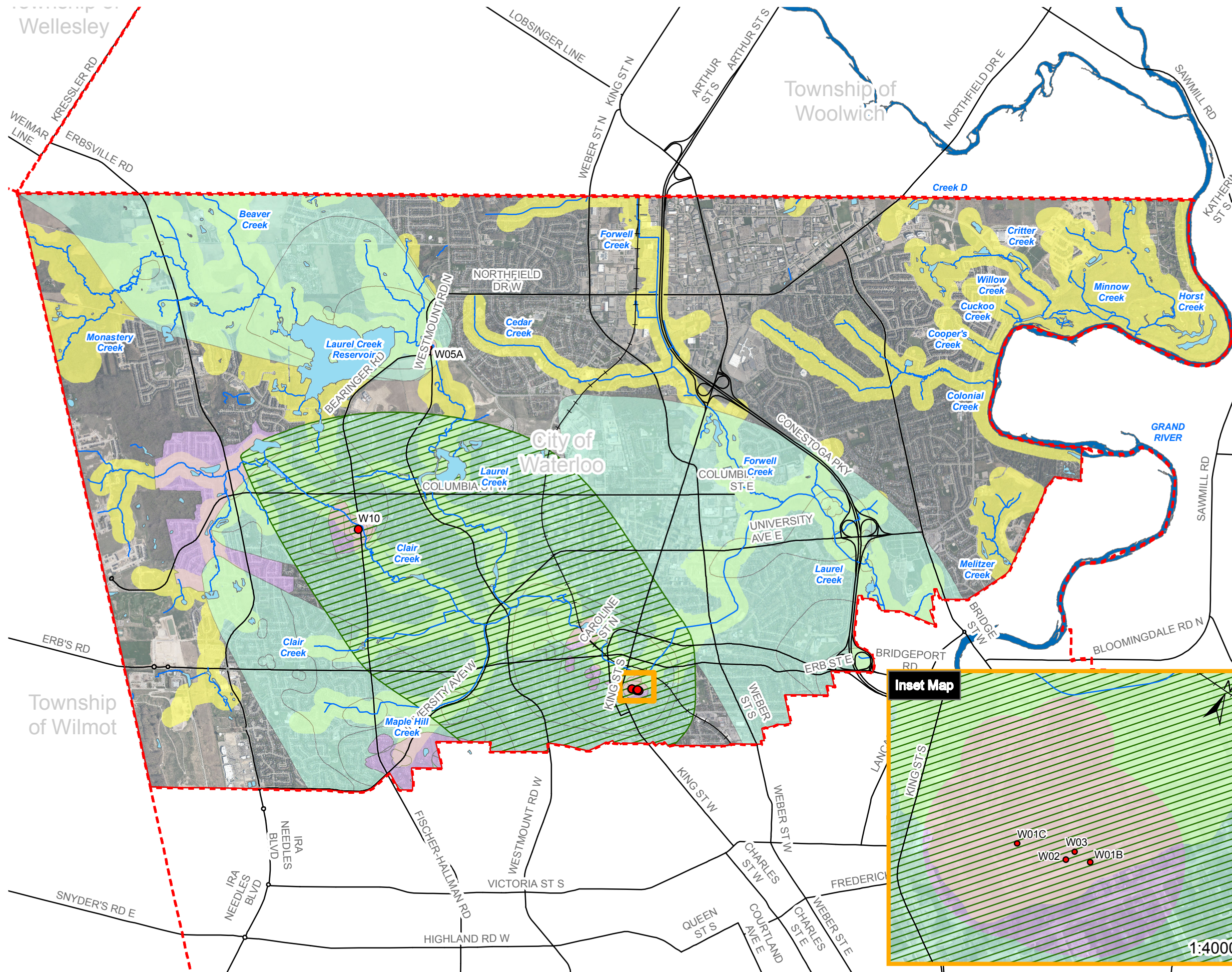
Well Field	Wells	Identified Issue & Associated Threat
William Street	W01B, W01C, W02	Chloride, Sodium and Trichloroethylene

**Issue Contributing Areas (ICAs)** have been developed in response to the identified issues for each of the aforementioned wells in the William Street well field. The corresponding ICA is illustrated in **Figure 1**. Due to the risk of groundwater contamination associated with infiltration of stormwater in these areas, it is recommended that stormwater infiltration practices in ICAs be limited to runoff originating from relatively clean sources of water such as landscaped areas (front, side or rear yards), rooftops (see **Section 4.0**) and local roads with rural cross-sections (see **Section 5.0**).

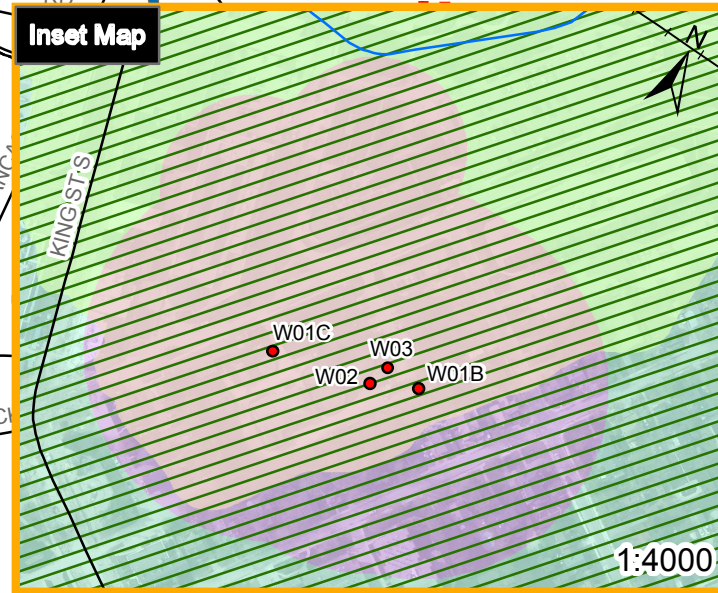


**MUNICIPAL CLASS EA  
STORMWATER MANAGEMENT  
MASTER PLAN**

**FIGURE 1:  
STORMWATER & INFILTRATION CONSTRAINTS**



- City of Waterloo Wells
- Watercourses
- Single Line Road Network
- Water Bodies
- Waterloo Boundary
- Municipal boundaries
- Issue Contributing Area - Chloride / Sodium / TCE
- Vulnerability Score 8 - 10
- Vulnerability Score 2 - 6.3
- Intake Protection Zone**
- IPZ-3



0 0.5 1 Kilometers





## 4.0 Land Use Based Infiltration Plan

General land use categories are identified below along with stormwater infiltration opportunities and constraints. The general goal of this land use based approach is to provide an effective way of identifying infiltration opportunities while protecting local groundwater resources from contamination, specifically for identified issues and threats (**Table 3.0**). Land use zoning from the City of Waterloo OP is identified in **Figure 2**.

### 4.1 High Risk Site Activities

For all sites, infiltration practices should not accept runoff from drainage areas within the site itself which are associated with higher risks such as fueling stations, waste disposal areas, vehicle washing stations, salt storage areas, stockpiling areas and shipping and receiving areas etc. Instead pollution prevention practices in the form of administrative and engineering controls should be applied in these areas.

**Table 4.0** identifies individual high risk site activities. High risk site activities are defined as those with the potential for high levels of contamination such as hydrocarbons, metals, organic and inorganic compounds, sediments and chlorides. At this scale of study, it is impossible to predict the ultimate site specific activities of individual sites; however, **Table 4.0** can be used a screening framework for identifying portions of each site where additional focus and review is needed to where LIDs should be discouraged, due to risk associated with the specific uses.

Drainage areas within each site with high risk activities (**Table 4.0**) will generally be discouraged from incorporating LID techniques that utilize infiltration as its primary function within the identified catchment because of the associated risk to groundwater contamination. However high risk site activities do not preclude the use of those LID techniques that utilize filtration, evapotranspiration (ET) or re-use as the primary processes. Additionally, the infiltration of rainwater from catchments not directly impacted by the respective high risk site activities such as rainwater emanating from rooftops, employee parking facilities or directly falling on permeable surfaces is generally considered relatively 'clean' and should not be excluded from infiltration.



**Table 4.0 - High Risk Site Activities**

<b>High Risk Site Activities which preclude the use infiltration-based LID BMPs within the contributing catchment area</b>		
<ul style="list-style-type: none"> <li>• Acid and Alkali Manufacturing, Processing and Bulk Storage</li> <li>• Adhesives and Resins Manufacturing, Processing and Bulk Storage</li> <li>• Airstrips and Hangars Operation</li> <li>• Antifreeze and De-icing Manufacturing and Bulk Storage</li> <li>• Asphalt and Bitumen Manufacturing</li> <li>• Battery Manufacturing, Recycling and Bulk Storage</li> <li>• Boat Manufacturing</li> <li>• Chemical Manufacturing, Processing and Bulk Storage</li> <li>• Coal Gasification</li> <li>• Commercial Autobody Shops</li> <li>• Commercial Trucking and Container Terminals</li> <li>• Concrete, Cement and Lime Manufacturing</li> <li>• Cosmetics Manufacturing, Processing and Bulk Storage</li> <li>• Crude Oil Refining, Processing and Bulk Storage</li> <li>• Discharge of Brine related to oil and gas production</li> <li>• Drum and Barrel and Tank Reconditioning and Recycling</li> <li>• Dye Manufacturing, Processing and Bulk Storage</li> <li>• Electricity Generation, Transformation and Power Stations</li> <li>• Electronic and Computer Equipment Manufacturing</li> <li>• Explosives and Ammunition Manufacturing, Production and Bulk Storage</li> </ul>	<ul style="list-style-type: none"> <li>• Explosives and Firing Range</li> <li>• Fertilizer Manufacturing, Processing and Bulk Storage</li> <li>• Fire Retardant Manufacturing, Processing and Bulk Storage</li> <li>• Fire Training</li> <li>• Flocculants Manufacturing, Processing and Bulk Storage</li> <li>• Foam and Expanded Foam Manufacturing and Processing</li> <li>• Garages and Maintenance and Repair of Railcars, Marine Vehicles and Aviation Vehicles</li> <li>• Gasoline and Associated Products Storage in Fixed Tanks</li> <li>• Glass Manufacturing</li> <li>• Importation of Fill Material of Unknown Quality</li> <li>• Ink Manufacturing, Processing and Bulk Storage</li> <li>• Iron and Steel Manufacturing and Processing</li> <li>• Metal Treatment, Coating, Plating and Finishing</li> <li>• Metal Fabrication</li> <li>• Mining, Smelting and Refining; Ore Processing; Tailings Storage</li> <li>• Oil Production</li> <li>• Operation of Dry Cleaning Equipment (where chemicals are used)</li> <li>• Ordnance Use</li> <li>• Paints Manufacturing, Processing and Bulk Storage</li> <li>• Pesticides (including Herbicides, Fungicides and Anti-Fouling Agents) Manufacturing, Processing, Bulk Storage and Large-Scale Applications</li> </ul>	<ul style="list-style-type: none"> <li>• Petroleum-derived Gas Refining, Manufacturing, Processing and Bulk Storage</li> <li>• Pharmaceutical Manufacturing and Processing</li> <li>• Plastics (including Fibreglass) Manufacturing and Processing</li> <li>• Port Activities, including Operation and Maintenance of Wharves and Docks</li> <li>• Pulp, Paper and Paperboard Manufacturing and Processing</li> <li>• Rail Yards, Tracks and Spurs</li> <li>• Rubber Manufacturing and Processing</li> <li>• Salt Manufacturing, Processing and Bulk Storage</li> <li>• Salvage Yard, including automobile wrecking</li> <li>• Snow Storage</li> <li>• Soap and Detergent Manufacturing, Processing and Bulk Storage</li> <li>• Solvent Manufacturing, Processing and Bulk Storage</li> <li>• Storage, maintenance, fuelling and repair of equipment, vehicles, and material used to maintain transportation systems</li> <li>• Tannery</li> <li>• Textile Manufacturing and Processing</li> <li>• Transformer Manufacturing, Processing and Use</li> <li>• Sewage Treatment and Sewage Holding Facilities</li> <li>• Vehicles and Associated Parts Manufacturing</li> <li>• Waste Disposal and Waste Management, including thermal treatment, landfilling and transfer of waste, other than use of biosoils as soil conditioners</li> <li>• Wood Treating and Preservative Facility and Bulk Storage of Treated and Preserved Wood Products</li> </ul>



WELLESLEY

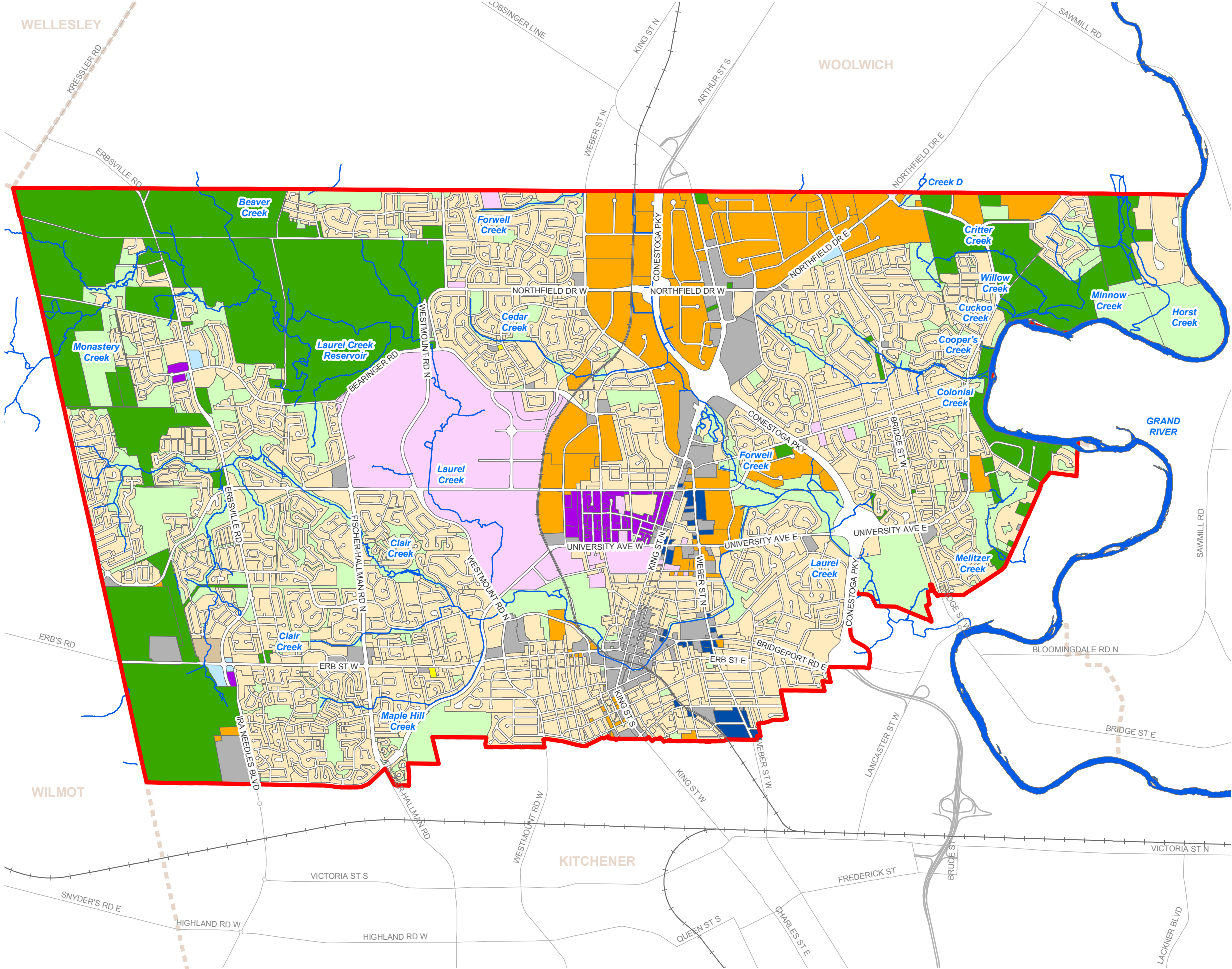
WOOLWICH



# MUNICIPAL CLASS EA STORMWATER MANAGEMENT MASTER PLAN

Figure 2  
LAND USE

- Study Area**
- Study Area
  - Watercourse
  - Mainline Railways
  - Road Centerline
- Land Use**
- Agricultural
  - Commercial
  - Green
  - Industrial
  - Industrial - Light
  - Industrial - Service Station
  - Institutional
  - Mixed-Use Commercial
  - Mixed-Use Employment
  - Mixed-Use Residential
  - Residential



0 0.5 1 Kilometers



Base data provided by The City of Waterloo, 2017.  
Date: June 2018

## 4.2 ICAs and WHPAs

For all sites within ICAs and/or WHPAs with adjusted vulnerability scores equal to or greater than 8, paved surfaces (roads, sidewalks and parking surfaces) should not be treated with stormwater infiltration practices. This is to prevent groundwater from salt based deicers commonly used on these surfaces in the winter.

## 4.3 Land Use Infiltration Policy Recommendations

The following outlines the infiltration policy recommendations for various land-uses as identified in the City's Zoning By-Law, including:

1. Residential;
2. Commercial;
3. Employment Land;
4. Institutional;
5. Open Space; and
6. Environmentally Sensitive Landscape.

There is less risk of groundwater contamination associated with the infiltration of runoff from pervious surfaces and relatively clean impervious surfaces such as roof tops and should be considered a priority for infiltration. There is however a need to infiltrate runoff from other impervious surfaces in order to reduce runoff and restore natural hydrologic processes. Taking these objectives and constraints into consideration, the policy recommendations outlined in Section 4.3 take a tiered risk-based approach. The policies take into consideration both the source of runoff and groundwater vulnerability. The policies impose greater restriction on infiltration practices within ICAs and WHPAs. **Table 4.1** summarizes the respective policy recommendations for the various land-uses and outlines the potential LID controls that are acceptable for implementation.

### 1. Residential

Within the City, residential zoning includes **Residential** and **Mixed-Use Residential** land uses.

#### a) Residential

Within **Residential areas not zoned as Mixed-Use Residential**, infiltration practices shall be generally encouraged for runoff originating from landscaped areas (front, side or rear yards), driveways and rooftops.

For **Residential areas not zoned as Mixed-Use Residential** within **ICAs and/or WHPAs with a vulnerability score equal to or greater than 8**, infiltration practices shall be encouraged only for runoff originating from landscaped areas (front, side or rear yards) and rooftops.

#### b) Mixed Use Residential

Within **Mixed Use Residential** areas (including Medium, Medium-High, and High Density areas), infiltration practices are generally encouraged for runoff originating from landscaped areas (front, side or rear yards), paved surfaces and rooftops.

For Mixed Use Areas within **WHPAs with a vulnerability score of 2 to 6 inclusive**, infiltration practices are encouraged for runoff originating from landscaped areas (front, side or rear yards), rooftops, and paved surfaces less than 200 m<sup>2</sup>. For paved surfaces between 200 to 2000 m<sup>2</sup>, infiltration practices are

encouraged only if a Salt Management Plan (SMP) is completed for the subject property. Infiltration practices are discouraged for runoff originating from paved surfaces in excess of 2000 m<sup>2</sup>.

For Mixed Use areas within **ICAs and/or WHPAs with a vulnerability score equal to or greater than 8**, infiltration practices are encouraged only for runoff origination from landscaped areas (front, side or rear yards) and rooftops.

Infiltration practices should not receive runoff from paved surfaces on Mixed Use areas where spills can cause damage to the infiltration practices and contamination of groundwater, these areas include, but are not limited to the following and those listed in **Table 4.0**:

- Fueling stations
- Waste disposal areas
- Vehicle washing stations
- Salt storage areas
- Stockpiling areas (soils, aggregate, landscape products, etc.)
- Shipping and receiving areas

## **2. Commercial**

Areas with commercial zoning serve a wide range of functions within the City. Within Commercial areas, infiltration practices are generally encouraged for runoff originating from landscaped areas (front, side or rear yards), paved surfaces and rooftops.

For Commercial areas within **WHPAs with a vulnerability score of 2 to 6 inclusive**, infiltration practices are encouraged for runoff originating from landscaped areas (front, side or rear yards), rooftops and paved surfaces less than 200 m<sup>2</sup>. For paved surfaces between 200 to 2000 m<sup>2</sup>, infiltration practices are encouraged only if a Salt Management Plan (SMP) is completed for the subject property. Infiltration practices are discouraged for runoff originating from paved surfaces in excess of 2000 m<sup>2</sup>.

Additionally, for commercial areas within **ICAs and/or WHPAs with a vulnerability score equal to or greater than 8**, infiltration practices are encouraged only for runoff origination from landscaped areas (front, side or rear yards) and rooftops.

Infiltration practices should not receive runoff from site areas where spills can cause damage to the infiltration practices and contamination of groundwater, these areas include, but are not limited to the following and those listed in **Table 4.0**:

- Automotive Fueling stations
- Waste disposal areas
- Vehicle washing stations
- Salt storage areas
- Stockpiling areas (soils, aggregate, landscape products, etc.)
- Shipping and receiving areas

## **3. Employment Land**

Areas zoned as employment land provide a broad range of employment opportunities to meet the needs of the City's employees, businesses and residents. Employment lands include **Business Employment** and **Flexible Industrial** zoning.

### **a) Business Employment**

Within areas zoned as **Business Employment**, infiltration practices are generally encouraged for runoff originating from landscaped areas (front, side or rear yards), paved surfaces and rooftops.

For areas zoned as **Business Employment** within **WHPAs with a vulnerability score of 2 to 6 inclusive**, infiltration practices are encouraged for runoff originating from landscaped areas (front, side or rear yards), rooftops and paved surfaces less than 200 m<sup>2</sup>. For paved surfaces between 200 to 2000 m<sup>2</sup>, infiltration practices are encouraged only if a Salt Management Plan (SMP) is completed for the subject property. Infiltration practices are discouraged for runoff originating from paved surfaces in excess of 2000 m<sup>2</sup>.

Additionally, for Employment Land within **ICAs and/or WHPAs with a vulnerability score equal to or greater than 8**, infiltration practices are encouraged only for runoff origination from landscaped areas (front, side or rear yards) and rooftops.

Infiltration practices should not receive runoff from site areas where spills can cause damage to the infiltration practices and contamination of groundwater, these areas include, but are not limited to the following and those listed in **Table 4.0**:

- Fueling stations
- Waste disposal areas
- Vehicle washing stations
- Salt storage areas
- Stockpiling areas (soils, aggregate, landscape products, etc.)
- Shipping and receiving areas

#### **b) Flexible Industrial**

For areas zoned as **Flexible Industrial**, infiltration practices are generally encouraged for runoff origination from landscaped areas (front, side or rear yards) and rooftops. Infiltration practices should not receive runoff from paved surfaces in sites zoned as flexible industrial. This applies both outside of and within the **ICAs and/or WHPAs with a vulnerability score equal to or greater than 8**.

With respect to the infiltration of roof runoff from lands zoned as **Flexible Industrial**, the City of Waterloo acknowledges the potential for contamination especially from damaged or improperly maintained rooftop industrial scrubbers. It is the City's intent to use a risk-based approach on these properties. As part the site plan review process, City Staff will prohibit the infiltration of stormwater from industrial roofs with scrubbers and/or that house scrubber waste including all liquid solutions, solids, pastes and powder waste products.

The City has taken this approach due to the large number of properties within the City that are zoned as **Flexible Industrial** but do not contain rooftop high risk activities. The roof tops of these sites are ideal candidates as sources of stormwater to be routed to infiltration practices due to their large impervious surfaces. The roofs at these sites pose a substantially lesser risk of groundwater contamination than onsite ground-level paved surfaces which are salted throughout the winter.

#### **4. Institutional**

Within areas zoned **Institutional**, infiltration practices are generally encouraged for runoff originating from landscaped areas (front, side or rear yards), paved surfaces and rooftops. Infiltration practices should not receive runoff from site areas where spills can cause damage to the infiltration practices and or contamination of groundwater (see **Table 4.0** and the bulleted list under commercial land use).



For areas zoned ***Institutional*** within **WHPAs with a vulnerability score of 2 to 6 inclusive**, infiltration practices are encouraged for runoff origination from landscaped areas (front, side or rear yards), rooftops and paved surfaces less than 200 m<sup>2</sup>. For paved surfaces between 200 to 2000 m<sup>2</sup>, infiltration practices are encouraged only if a Salt Management Plan (SMP) is completed for the subject property. Infiltration practices are discouraged for runoff originating from paved surfaces in excess of 2000m<sup>2</sup>.

For Institutional areas within **ICAs and/or WHPAs with a vulnerability score equal to or greater than 8**, infiltration practices are encouraged only for runoff origination from landscaped areas (front, side or rear yards) and rooftops.

### **5. Open Space**

Areas that are zoned ***Open Space*** may include parks, golf courses and conservation lands. Within ***Open Space*** areas, infiltration practices shall be encouraged for runoff origination from landscaped areas, paved surfaces and rooftops (as applicable).

For ***Open Space*** areas within **WHPAs with a vulnerability score of 2 to 6 inclusive**, infiltration practices are encouraged for runoff origination from landscaped areas, rooftops and paved surfaces less than 200 m<sup>2</sup>. For paved surfaces between 200 to 2000 m<sup>2</sup>, infiltration practices are encouraged only if a Salt Management Plan (SMP) is completed for the subject property. Infiltration practices are discouraged for runoff originating from paved surfaces in excess of 2000m<sup>2</sup> unless the paved surface receives no salt applications or is closed/ not maintained during winter months.

For ***Open Space*** areas within **ICAs and/or WHPAs with a vulnerability score equal to or greater than 8**, infiltration practices shall be encouraged only for runoff origination from landscaped areas and rooftops (as applicable).

Infiltration practices should not receive runoff from site areas where spills can cause damage to the infiltration practices and contamination of groundwater, these areas include, but are not limited to the following and those listed in **Table 4.0**:

- Fueling stations
- Waste disposal areas
- Vehicle washing stations
- Salt storage areas
- Stockpiling areas (soils, aggregate, landscape products, etc.)
- Areas of fertilizer storage or application
- Areas of pesticide storage or application

### **6. Environmentally Sensitive Landscape**

Areas that are zoned ***Environmentally Sensitive Landscape*** may include agricultural uses, conservation lands, municipal parkland, trails and pathways. Within ***Environmentally Sensitive Landscape*** areas, infiltration practices shall be encouraged for runoff origination from landscaped areas, paved surfaces and rooftops (as applicable).

For ***Environmentally Sensitive Landscape*** areas within **WHPAs with a vulnerability score of 2 to 6 inclusive**, infiltration practices are encouraged for runoff origination from landscaped areas (front, side or rear yards), rooftops and paved surfaces less than 200 m<sup>2</sup>. For paved surfaces between 200 to 2000 m<sup>2</sup>, infiltration practices are encouraged only if a Salt Management Plan (SMP) is completed for the subject property. Infiltration practices are discouraged for runoff originating from paved



surfaces in excess of 2000m<sup>2</sup> unless the paved surface receives no salt applications or is closed/ not maintained during winter months.

For ***Environmentally Sensitive Landscape*** areas within **ICAs and/or WHPAs with a vulnerability score equal to or greater than 8**, infiltration practices shall be encouraged only for runoff origination from landscaped areas and rooftops (as applicable).

Infiltration practices should not receive runoff from site areas where spills can cause damage to the infiltration practices and contamination of groundwater, these areas include, but are not limited to the following and those listed in **Table 4.0**:

- Fueling stations
- Waste disposal areas
- Vehicle washing stations
- Salt storage areas
- Stockpiling areas (soils, aggregate, landscape products, etc.)
- Chemical storage or transfer locations

**Table 4.1: Land Use- Infiltration Opportunities and Constraints**

Land Use	<u>Inside</u> ICAs and/or WHPAs with Adjusted Vulnerability Scores equal to or greater than 8			<u>Outside</u> ICAs but <u>within</u> WHPAs with Adjusted Vulnerability Scores from 2 through 6			<u>Outside</u> ICAs and <u>Outside</u> WHPAs		
	Opportunities	Constraints	Acceptable Practices	Opportunities	Constraints	Acceptable Practices	Opportunities	Constraints	Acceptable Practices
<b>Residential</b>	Landscaped Areas and Rooftops	High Risk Site Activities (Table 4.0)	Soakaways, Infiltration Trenches and Chambers; Downspout Disconnection & Bioretention (Rain Gardens)	Landscaped Areas, Driveways and Rooftops	High Risk Site Activities (Table 4.0)	Soakaways, Infiltration Trenches and Chambers; Downspout Disconnection & Bioretention (Rain Gardens)	Landscaped Areas, Driveways and Rooftops	High Risk Site Activities (Table 4.0)	Soakaways, Infiltration Trenches and Chambers; Downspout Disconnection & Bioretention (Rain Gardens)
<b>Mixed Use Residential</b>	Landscaped Areas and Rooftops	Paved Surfaces and High Risk Site Activities (Table 4.0)	Soakaways, Infiltration Trenches and Chambers; Downspout Disconnection & Bioretention	Landscaped Areas, Paved Surfaces (less than 2000m <sup>2</sup> ) and Rooftops	Paved Surfaces (larger than 2000 m <sup>2</sup> ) and High Risk Site Activities (Table 4.0)	Soakaways, Infiltration Trenches and Chambers; Downspout Disconnection & Bioretention	Landscaped Areas, Paved Surfaces and Rooftops	High Risk Site Activities (Table 4.0)	Soakaways, Infiltration Trenches and Chambers; Downspout Disconnection; Bioretention & Permeable Pavements
<b>Commercial</b>	Landscaped Areas and Rooftops	Paved Surfaces and High Risk Site Activities (Table 4.0)	Soakaways, Infiltration Trenches and Chambers; Downspout Disconnection & Bioretention	Landscaped Areas, Paved Surfaces (less than 2000m <sup>2</sup> ) and Rooftops	Paved Surfaces (larger than 2000 m <sup>2</sup> ) and High Risk Site Activities (Table 4.0)	Soakaways, Infiltration Trenches and Chambers; Downspout Disconnection & Bioretention	Landscaped Areas, Paved Surfaces and Rooftops	High Risk Site Activities (Table 4.0)	Soakaways, Infiltration Trenches and Chambers; Downspout Disconnection; Bioretention & Permeable Pavements
<b>Business Employment</b>	Landscaped Areas and Rooftops	Paved Surfaces and High Risk Site Activities (Table 4.0)	Soakaways, Infiltration Trenches and Chambers; Downspout Disconnection & Bioretention	Landscaped Areas, Paved Surfaces (less than 2000m <sup>2</sup> ) and Rooftops	Paved Surfaces (larger than 2000 m <sup>2</sup> ) and High Risk Site Activities (Table 4.0)	Soakaways, Infiltration Trenches and Chambers; Downspout Disconnection & Bioretention	Landscaped Areas, Paved Surfaces and Rooftops	High Risk Site Activities (Table 4.0)	Soakaways, Infiltration Trenches and Chambers; Downspout Disconnection; Bioretention & Permeable Pavements
<b>Flexible Industrial</b>	Landscaped Areas and Rooftops	Paved Surfaces and High Risk Site Activities (Table 4.0)	Soakaways, Infiltration Trenches and Chambers; Downspout Disconnection & Bioretention	Landscaped Areas and Rooftops	Paved Surfaces and High Risk Site Activities (Table 4.0)	Soakaways, Infiltration Trenches and Chambers; Downspout Disconnection & Bioretention	Landscaped Areas and Rooftops	Paved Surfaces and High Risk Site Activities (Table 4.0)	Soakaways, Infiltration Trenches and Chambers; Downspout Disconnection & Bioretention
<b>Institutional</b>	Landscaped Areas and Rooftops	Paved Surfaces and High Risk Site Activities (Table 4.0)	Soakaways, Infiltration Trenches and Chambers; Downspout Disconnection & Bioretention	Landscaped Areas, Paved Surfaces (less than 2000m <sup>2</sup> ) and Rooftops	Paved Surfaces (larger than 2000 m <sup>2</sup> ) and High Risk Site Activities (Table 4.0)	Soakaways, Infiltration Trenches and Chambers; Downspout Disconnection & Bioretention	Landscaped Areas, Paved Surfaces and Rooftops	High Risk Site Activities (Table 4.0)	Soakaways, Infiltration Trenches and Chambers; Downspout Disconnection; Bioretention & Permeable Pavements
<b>Open Space</b>	Landscaped Areas and Rooftops	Paved Surfaces and High Risk Site Activities (Table 4.0)	Soakaways, Infiltration Trenches and Chambers; Downspout Disconnection & Bioretention	Landscaped Areas, Paved Surfaces (less than 2000m <sup>2</sup> ) and Rooftops	Paved Surfaces (larger than 2000 m <sup>2</sup> ) and High Risk Site Activities (Table 4.0)	Soakaways, Infiltration Trenches and Chambers; Downspout Disconnection & Bioretention	Landscaped Areas, Paved Surfaces and Rooftops	High Risk Site Activities (Table 4.0)	Soakaways, Infiltration Trenches and Chambers; Downspout Disconnection; Bioretention & Permeable Pavements
<b>Environmentally Sensitive Landscape</b>	Landscaped Areas and Rooftops	Paved Surfaces and High Risk Site Activities (Table 4.0)	Soakaways, Infiltration Trenches and Chambers; Downspout Disconnection & Bioretention	Landscaped Areas, Paved Surfaces (less than 2000 m <sup>2</sup> ) and Rooftops	Paved Surfaces (larger than 2000 m <sup>2</sup> ) and High Risk Site Activities (Table 4.0)	Soakaways, Infiltration Trenches and Chambers; Downspout Disconnection & Bioretention	Landscaped Areas, Paved Surfaces and Rooftops	High Risk Site Activities (Table 4.0)	Soakaways, Infiltration Trenches and Chambers; Downspout Disconnection; Bioretention & Permeable Pavements

## 5.0 Infiltration Plan for Municipal Roads

Roads segments often bisect multiple land uses and as such require their own infiltration policy. The City of Waterloo roads classification system is based on people movement and includes the classifications identified in **Table 5.0**.

**Section 5.1 through 5.3** recommend specific infiltration policies based on road type, local groundwater vulnerability and groundwater issues identified in the Grand River Source Protection Plan. Where a street falls into **more than one category** (e.g. within WHPA Adjusted Vulnerability Score of 8 and within ICA) the more stringent constraints on infiltration practices are to apply. **Table 5.1** summarizes the respective policy recommendations for the various road classifications and outlines the potential LID controls that are acceptable for implementation.

### 5.1 Roads within ICAs

To avoid contamination from road deicers, in general runoff **from all road segments within ICAs should not be conveyed to infiltration practices**. This prohibition includes the use of flexible liners and or gated/ closeable inlets to prevent infiltration of runoff due to the potential for punctures and or winter by-pass, respectively. Should 'permanent' and or 'hardened' impermeable closed bottom structure be used (i.e. plastic or concrete tanks, vaults, or chambers) be proposed, explicit approval from the Region of Waterloo shall be obtained.

These roads should alternatively be treated using conventional stormwater management controls such as ponds, wetlands and hybrid facilities as well as hydrodynamic separators (OGS units) and or membrane filtration units (i.e. Jellyfish filters).

#### *5.1.1 Local Rural Cross-section Roads within ICAs - Exemption*

One exception for roads within ICAs is for **local roads with existing rural-cross-sections**. These roads already contribute to chloride loading (though significantly less than minor and major roads per unit length) and it is unlikely that directing runoff from existing grassed ditches to infiltration practices will exacerbate the issue or increase the threat, provided:

- a) The proposed infiltration facility footprint is no larger than the existing ditch footprint;  
or
- b) The proposed annual infiltration volume is not increased as compared to the existing condition (ditch) annual infiltration volume based on the characterization of the limiting in-situ native soils (i.e. infiltration rate(s) per the LID Stormwater Planning and Design Guide (2010 V1.0 or most recent).

Local roads meeting the above exemption clauses should be subject to further salt reduction/salt management measures (including no salting, if possible) which should be considered as part of detailed design recommendations. These measures are to be integrated in the City-Wide Salt Management Strategy as required.

### 5.2 Roads within WHPAs

Where the **Adjusted Vulnerability Rating is 8 to 10**, infiltration practices are not recommended for any road type. This is due to the short travel times to the wells and associated risk of groundwater contamination.

Within a WHPA where there the **Adjusted Vulnerability Rating is less than 8** (i.e. the Vulnerability Rating is 2 to 6, inclusive), infiltration practices are recommended for **Local Roads and Laneways only**. Local roads and Laneways have less intensive winter deicer application as a result of lower usage and posted speed limits.

### **5.3 Roads outside of ICAs and WHPAs**

Outside of ICAs and WHPAs, road runoff can be conveyed to infiltration practices from **all road types**. Runoff originating from **City Arterial** and **Major Collector** roads can only be directed to infiltration practices provided a project specific Groundwater Impact Analysis study is undertaken to demonstrate that groundwater contamination (especially from salt loading) is minimal, not likely or can be mitigated.

For all road types, it is important to review land use within the area serviced by each road before implementing infiltration practices. Runoff from road segments that services high risk activities especially those where spills of hazardous materials are more likely should include a spill capture plan/ structures or not conveyed to infiltration practices.

**Table 5.0: Municipal Road Classification and Characteristics**

Road Classification Characteristics	Road Classification				
	City Arterial	Major Collector	Minor Collector	Local	Laneway
ROW Width	30 – 35 m	20 – 30 m	18 – 20 m	16 – 18 m	6 m
Pavement Width	11 – 18 m	11 – 15 m	8 – 11 m	8 – 9 m	6 m
Vehicle Types	All Types, Truck Route	Residential: Passenger & Service Vehicle Industrial/Commercial: All Types	Residential: Passenger & Service Vehicle Industrial/Commercial: All Types	Residential: Passenger & Service Vehicle Industrial/Commercial: All Types	Residential: Passenger & Service Vehicle Industrial/Commercial: Restricted
Streetscape Features	Opportunities for Basic and Enhanced Streetscape features involving furniture, lighting, trees and landscaping	Opportunities for Basic and Enhanced Streetscape features involving furniture, lighting, trees and landscaping	Opportunities for primarily Basic Streetscape features involving boulevard landscaping and sidewalks	Opportunities for primarily Basic Streetscape features involving boulevard landscaping and sidewalks	Limited to streetlighting and drainage opportunities in laneways
Existing/Planned Adjacent Land Use	Medium/High Density Mixed Use Development and Major Traffic Attractions	Mixed Land Use in Range of Low/Medium Density	Primarily Low/Medium Density Development in Residential Neighbourhoods and Employment Areas	Primarily Low Density Residential Neighbourhood and Employment Areas	Low Density Residential Neighbourhood with Frontages on Public Street
User Volume (Typical Motorized Traffic AADT)	12,000 – 30,000	< 12,000	< 5,000	< 2,000	Local Access Only
User Volume (Pedestrians)	High	High	Medium	Low	Local Access Only with No Sidewalks
Design Speed	70 km/h maximum	60 km/h	50 km/h	50 km/h	30 km/h maximum
On-Street Parking Provisions	Generally Restricted	Generally Restricted	Permitted on One or Both Sides	Permitted on One or Both Sides	Parking Generally Restricted on a Laneway

<sup>1</sup> Based on City of Waterloo Urban Design Manual and Development Manual (Revised from City of Waterloo Transportation Master Plan, 2011)



**Table 5.1: Recommended Road Classification Based Infiltration Policy and Acceptable Practices**

Road Classification	Cross- Section	Inside ICAs		Inside WHPAs with Adjusted Vulnerability Scores equal to or greater than 8		Inside WHPAs with Adjusted Vulnerability Scores from 2 through 6		Outside ICAs and Outside WHPAs	
		Recommended Policy	Acceptable Practices	Recommended Policy	Acceptable Practices	Recommended Policy	Acceptable Practices	Recommended Policy	Acceptable Practices
Laneway	Urban & Rural Cross Section	Not to be conveyed or treated using infiltration based practices.	Convey to downstream SWM facility or Hydrodynamic separators (OGS units) and or membrane filtration units	Not to be conveyed or treated using infiltration based practices.	Convey to downstream SWM facility or Hydrodynamic separators (OGS units) and or membrane filtration units	Permissible to conveyed or treated using infiltration based practices.	Bioretention (Dry Swales/ Bioswale, Boulevard units & Bump-outs), Perforated Pipes, Permeable Pavements & Enhanced Swales	Permissible to conveyed or treated using infiltration based practices.	Bioretention (Dry Swales/ Bioswale, Boulevard units & Bump-outs), Perforated Pipes, Permeable Pavements & Enhanced Swales
Local	Urban Cross Section (i.e. Curb and Gutter)	Not to be conveyed or treated using infiltration based practices.	Convey to downstream SWM facility or Hydrodynamic separators (OGS units) and or membrane filtration units	Not to be conveyed or treated using infiltration based controls.	Convey to downstream SWM facility or Hydrodynamic separators (OGS units) and or membrane filtration units	Permissible to conveyed or treated using infiltration based practices.	Bioretention (Dry Swales/ Bioswale, Boulevard units & Bump-outs), Perforated Pipes, Permeable Pavements & Enhanced Swales	Permissible to conveyed or treated using infiltration based practices.	Bioretention (Dry Swales/ Bioswale, Boulevard units & Bump-outs), Perforated Pipes, Permeable Pavements & Enhanced Swales
	Rural Cross Section (i.e. Ditched)	Permissible to conveyed or treated using infiltration based practices provided condition 5.1.1a) or 5.1.1b) can be met.	Bioretention (Dry Swales/ Bioswale, Boulevard units & Bump-outs), Perforated Pipes, Permeable Pavements & Enhanced Swales						
Minor Collector	Urban & Rural Cross Section	Not to be conveyed or treated using infiltration based practices.	Convey to downstream SWM facility or Hydrodynamic separators (OGS units) and or membrane filtration units	Not to be conveyed or treated using infiltration based practices.	Convey to downstream SWM facility or Hydrodynamic separators (OGS units) and or membrane filtration units	Not to be conveyed or treated using infiltration based practices.	Convey to downstream SWM facility or Hydrodynamic separators (OGS units) and or membrane filtration units	Permissible to conveyed or treated using infiltration based practices.	Bioretention (Dry Swales/ Bioswale, Boulevard units & Bump-outs), Perforated Pipes, Permeable Pavements & Enhanced Swales
Major Collector	Urban & Rural Cross Section	Not to be conveyed or treated using infiltration based practices.	Convey to downstream SWM facility or Hydrodynamic separators (OGS units) and or membrane filtration units	Not to be conveyed or treated using infiltration based practices.	Convey to downstream SWM facility or Hydrodynamic separators (OGS units) and or membrane filtration units	Not to be conveyed or treated using infiltration based practices.	Convey to downstream SWM facility or Hydrodynamic separators (OGS units) and or membrane filtration units	Permissible to conveyed or treated using infiltration based practices provided a project specific Groundwater Impact Analysis study is undertaken to demonstrate that groundwater contamination (especially from salt loading) is minimal, not likely or can be mitigated.	Bioretention (Dry Swales/ Bioswale, Boulevard units & Bump-outs), Perforated Pipes, Permeable Pavements & Enhanced Swales
City Arterial	Urban & Rural Cross Section	Not to be conveyed or treated using infiltration based practices.	Convey to downstream SWM facility or Hydrodynamic separators (OGS units) and or membrane filtration units	Not to be conveyed or treated using infiltration based practices.	Convey to downstream SWM facility or Hydrodynamic separators (OGS units) and or membrane filtration units	Not to be conveyed or treated using infiltration based practices.	Convey to downstream SWM facility or Hydrodynamic separators (OGS units) and or membrane filtration units	Permissible to conveyed or treated using infiltration based practices provided a project specific Groundwater Impact Analysis study is undertaken to demonstrate that groundwater contamination (especially from salt loading) is minimal, not likely or can be mitigated.	Bioretention (Dry Swales/ Bioswale, Boulevard units & Bump-outs), Perforated Pipes, Permeable Pavements & Enhanced Swales